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MADE

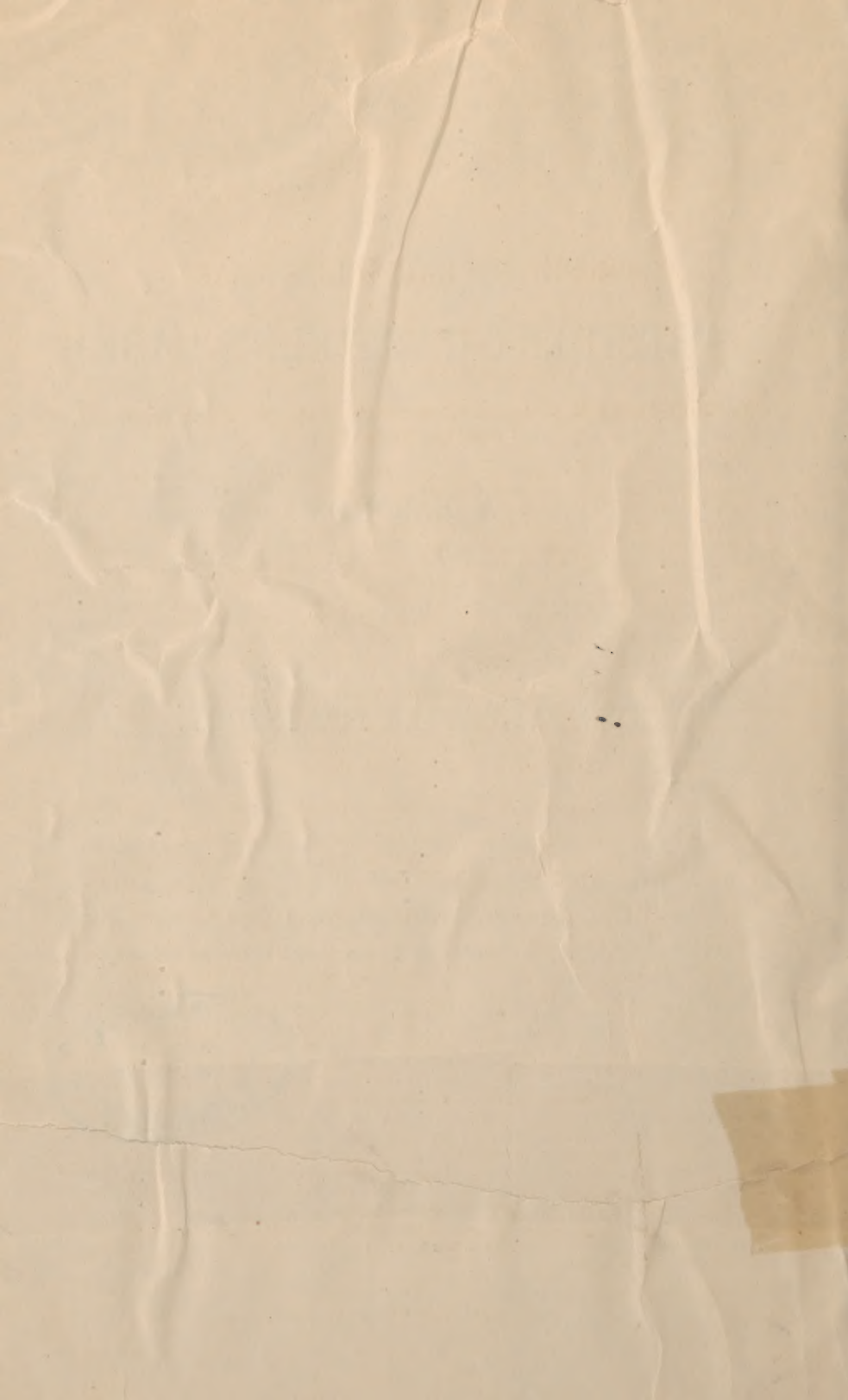
TWO DAYS AFTER THE INJURY.

By FRANK BAKER, M. D.,

Assistant Demonstrator of Anatomy, Medical Department, Columbian University.



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PRESIDENT GARFIELD'S CASE.

A DIAGNOSIS MADE JULY 4TH.

By FRANK BAKER, M. D., Assistant Demonstrator of Anatomy, Medical Department,
Columbian University.

During the first few hours after President Garfield was wounded there was every reason to expect his speedy dissolution. From the locality of the wound, it seemed impossible that some vital organ should not be injured, and the symptoms were of the gravest character. But, to the astonishment of all, the patient survived thirty-six hours, and began to rally. On the morning of July 4th, when a decided improvement was apparent, it occurred to me that the course of the ball had been mistaken. At that time it was believed the liver had been penetrated, and that Dr. Wales had touched its tissue with his little finger through the wound of entrance. As it seemed doubtful whether the liver could be touched by the little finger at a point on the eleventh rib three and a half inches from the spine, in a man of the President's size, I was led to think of other indications as to the course of the ball.

The following symptoms were developed: A painful prickling sensation in both feet—there being no difference apparent in the sensations of the two, considerable pain in the back, and an alteration of sensation on the right side of the scrotum, the left side remaining normal. There was no paralysis and no local increase of temperature of feet or scrotum; showing that the sensations were not due to local inflammation.

The well-known maxim of Hilton, as to the diagnostic value of pain, is as follows:

*"Superficial pains on both sides of the body, which are symmetrical, imply an origin or cause, the seat of which is central or bilateral; while unilateral pain implies a seat of origin which is one-sided, and as a rule, exists on the same side of the body as the pain."**

It is clear that this maxim may be also applied to symptoms of nervous disturbance other than pain.

In applying this to the President's case, it is observed that the pain in the feet was *symmetrical*, its cause was therefore *central*. The nerves of sensation for the feet being derived from the great sciatic nerve, the sensations denote a lesion of the spinal centre connected with that nerve. This centre is located by Malgaigne and Seguin opposite the body of the first lumbar vertebra. The sensation on the right side of the scrotum was not symmetrical but *unilateral*; its origin must, therefore, be looked for on the same side of the body as the pain. The ilio-inguinal nerve is distributed to the cutaneous surface of the scrotum, and an injury to it at any point of its course would occasion the sensation noted. On tracing it back from its distribution, it is found to pass up behind the abdominal cavity across the quadratus lumborum, and through the substance of the psoas muscle, joining the ilio-hypogastric nerve and uniting with the spinal cord behind the body of the first lumbar vertebra. It also obtains some fibres of origin from a branch which passes from the twelfth dorsal to the first lumbar nerve, directly along the side of the body of the first lumbar vertebra.

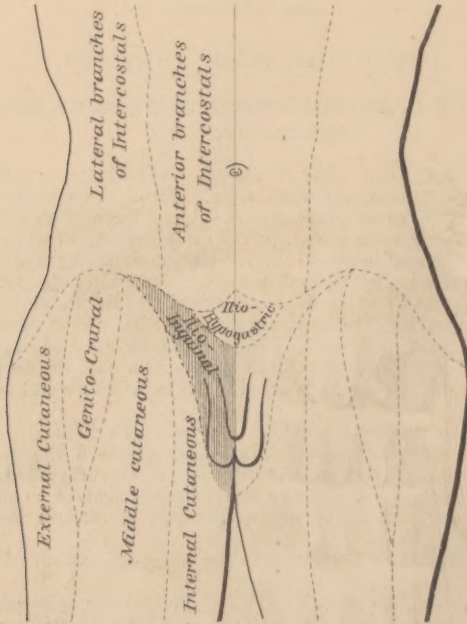
An inspection of the figure below (adapted from Flower) will show that the distribution of nerves to the cutaneous surface of the abdomen and upper thighs is very precisely limited.

* *Rest and Pain*, New York, 1879, p. 51.

The shaded portion indicates the point where an injury to the right ilio-inguinal nerve would be denoted.*

The symptoms above mentioned were so significant that, on the morning of July 4th, two days after the President was shot, I stated to several friends, among whom were Rear-Admiral T. A. Jenkins, U. S. N., Mr. A. B. Johnson, chief clerk of the Light-House Board, and, a day or two later, Commander George

Fig. 1.



Dewey, U. S. N., that the ball had probably entered the body of the first lumbar vertebra, injuring the ilio-inguinal nerve and causing concussion of the spinal cord, but not cutting it. Other reasons were alleged in support of this view, as follows:

The *shock* was immediate and very grave, so grave that the President fell instantly toward his right, *as if* paralyzed, which would indicate concussion of the cord. A man may walk or run a considerable distance after a severe wound of the liver, intestines, or other abdominal viscera.

He *vomited* immediately; this indicated a shock or injury to the solar plexus of nerves, situated in front of the first lumbar vertebra around the aorta and its great abdominal branches the coeliac axis and the superior mesenteric arteries. It is well known that a sudden shock to this plexus, as a blow on the walls of the abdomen, will cause sudden vomiting or even death.

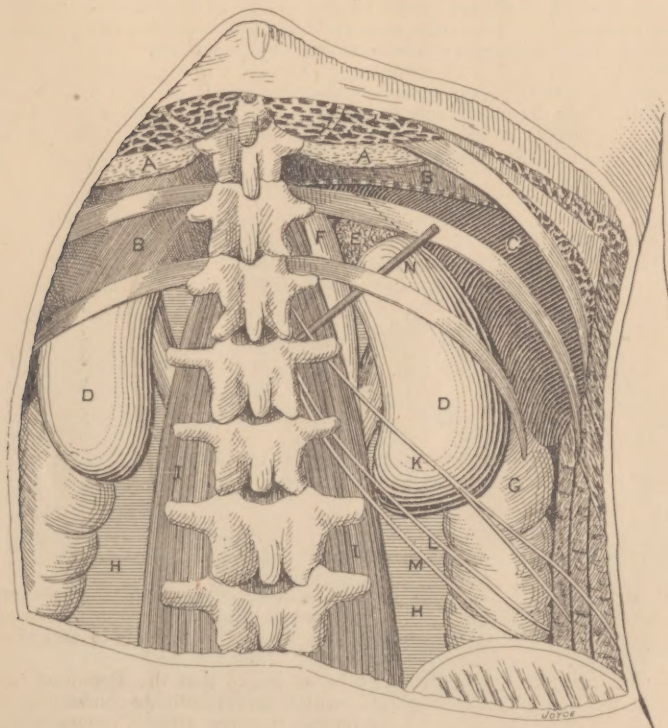
The *internal hemorrhage* appeared from the symptoms to be very great. This indicated that some large artery was cut. The wound was too high for the right renal artery, the lumbar and supra-renal arteries are not large. It would appear that one of the great abdominal arteries in front or to the left of the spine must have been injured. This might be either the splenic or the pancreatico-duodenal branch of the superior mesenteric.

An accurate knowledge of the topographical anatomy of the region immediately

* I have lately been informed that both pain and hyperæsthesia existed in the lower abdominal region. This being the area of distribution of the lower dorsal and ilio-hypogastric nerves, such symptoms would give additional weight to the diagnosis.

subja-cent to the wound shows that it was possible that the ball had not penetrated the liver. Having recently lectured on the relations of the lungs and diaphragm to the liver, I was struck by the fact that ordinary anatomical works are silent with regard to the relations of the liver to the spine and lower ribs behind, and that, as there is seldom occasion to examine this part of the body, there is a tendency among physicians to take it for granted that the liver fills up the entire back-space below the lungs down to the lower border of the twelfth rib. That this is not the fact will be seen by a glance at the diagram below, which represents the true relations of the lung, liver, and kidney on the right side posteriorly.

FIG. 2.



A. Lung. B. Diaphragm. C. Liver. D. Kidney. E. Supra-renal Capsule. F. Vena-cava. G. Ascending Colon. H. Peritoneum over Intestines. I. Psoas. K. Twelfth Dorsal Nerve. L. Ilio-hypogastric Nerve. M. Ilio-inguinal Nerve. N. Probe inserted in possible course of ball from Eleventh Rib to First Lumbar Vertebra.

The portion of the liver below the lung is quite narrow, and lies well up under the arch of the diaphragm, conforming to it in shape. Its lower border extends from the body of the tenth dorsal vertebra, curving outward and downward to the upper edge of the twelfth rib. The posterior surface (called by Gray the posterior border) is quite narrow, being at its widest part, which is well around under the axilla, only three inches wide. It would be quite possible for a ball to pass under this arch toward the spine without wounding either liver or kidney.

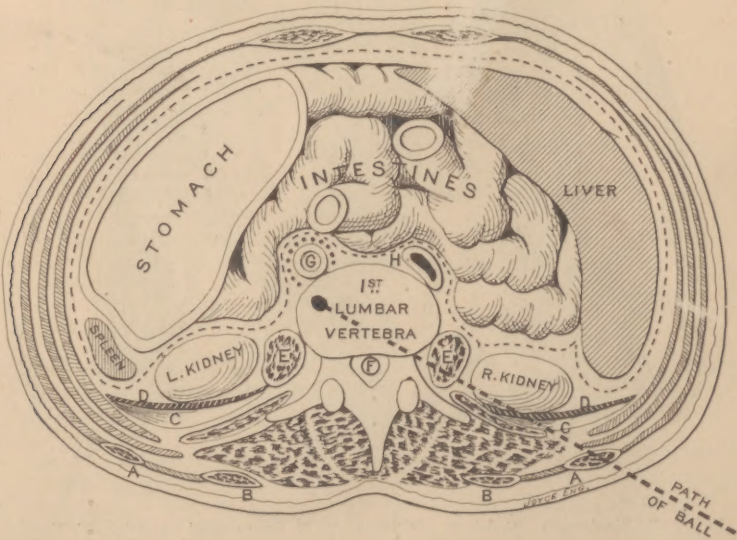
The *external hemorrhage* was not sufficient to account for the gravity of the symptoms. Had the liver been wounded it is hardly possible that this should have been the case. The veins of the liver being adherent to its tissue, remain patulous when cut across, and are not easily plugged by a clot, as are cut vessels of the same size elsewhere.

At the situation of the wound, the liver is probably not covered by the peritoneum, but adherent to the under surface of the diaphragm between the folds of the great coronary ligament. A hemorrhage from its tissue would not be likely to escape into the peritoneal cavity.

It seemed impossible that a ball of the size used (calibre 44, weighing 200 grains and impelled by 23 grains of powder,) fired from so short a range, should not have gone through the body had there been nothing to oppose it but a rib and a mass of liver-tissue of but little density. I was informed by a gentleman of experience with a pistol of the kind used by the assassin, that he had with it frequently sent a ball through five or six inches of pine plank. The commission that afterwards tested the pistol reported that, firing at a target of six pine boards, each one inch thick and placed behind each other at distances of one inch, the average penetration was three inches of soft pine. It was evident that the ball had great momentum. The large column of the spine seemed the only structure which could offer a resistance adequate to stop such a missile.

As the distinguished patient continued to survive without marked evidences of injury to either kidneys, liver, or intestines, I became more and more convinced of the truth of my diagnosis, and prepared a diagram, a copy of which appears below. It represents a cross section of the human body at the first lumbar vertebra and below the pancreas.

FIG. 3.



A. Eleventh Rib. B. Twelfth Rib. C. Pleural cavity. D. Diaphragm. E. Psoas muscle. F. Spinal Cord. G. Aorta surrounded by solar plexus. H. Vena-cava. The dotted line represents the peritoneum.

This diagram was hastily prepared, without reference to any existing representation of the same region, but it is believed to be correct with regard to the main points involved. It was my intention to carefully revise it so as to make it absolutely correct anatomically, and then to publish it in some medical journal. The large area given to the stomach was shown for the reason that the injury was received directly after a hearty meal, and therefore during a state of distention of that viscus. For the same reason a comparatively small area of liver is shown, it being pushed upward and outward by the distended stomach.

In order to test my conclusions by reference to physicians of greater experience, this diagram was shown on the evening of July 7th last to Dr. D. W. Prentiss, Dr. Smith Townshend, and Dr. N. S. Lincoln, of this city.

Although the ball was represented as lodged in the body of the vertebra, it was distinctly stated to all these gentlemen that it was my opinion that it had possibly passed beyond, and would be found in the tissue behind the peritoneum.

It was further stated that a horizontal section, like that shown in the figure, represented my idea of the course of the ball rather imperfectly. A pistol held at the usual height must necessarily have the muzzle somewhat depressed if the ball takes effect on the eleventh rib of a person less than ten feet away. The trajectory would, therefore, incline more or less downward, and could not be shown by a horizontal section. It was also my opinion that the liver might be grazed by the ball, its position being, to a certain extent, variable, as above stated.

Dr. Prentiss stated that he had been of the opinion from the first that the spine was injured, and Dr. Townshend was able to confirm my information as to the manner in which the President fell, the fact that there was no paralysis, and the early symptoms in the case.

As Dr. Lincoln had been connected with the case, his opinion was especially sought. He informed me that his attention had been particularly directed to the pains in the President's feet, which were severe and prolonged, resisting the anodyne effects of hypodermic injections. The patient described the pain as located in the soles of the feet, the region of distribution of the posterior tibial nerve. This at once directed Dr. Lincoln's attention to a possible injury of the spine, and he asked if any difference could be distinguished in the sensations of the two feet. The President, after careful consideration, replied that he could perceive no difference. Dr. Lincoln then supposed that the spine was certainly injured, or that the ball had possibly passed downward into the pelvic cavity and rested on the hypogastric plexus. The statement of Dr. Wales that he had passed his finger into the liver was, however deemed conclusive, as it was extremely unlikely that a surgeon of his reputation should be deceived. It was therefore probable that the ball, after wounding the liver, had taken some erratic course which could not be determined.

Since the diagnosis made by Dr. Wales was accepted by all connected with the case, I felt that it was improper to urge views which were diametrically opposed to those of gentlemen of acknowledged skill and experience who had had an opportunity of examining the wound. Besides, I wished to test the value of my anatomical deductions on a cadaver, and had no opportunity of doing so at that time. The experiments of Dr. Weisse, of New York, which were published shortly after, seemed to show that the bullet had been powerfully deflected by the rib, and had taken a downward course among the muscles of the back, cutting the ilio-inguinal nerve as it lay on the quadratus lumborum and injuring the sacral plexus. This course would partially account for the symptoms.

The developments of the autopsy show that the diagnosis made by me on July 4th was substantially correct. The path of the ball was from right to left, forward and downward.*

* In the report of the case made by Dr. Bliss (New York *Medical Record*, October 8, 1881,) he assumes that the ball, after penetrating the skin in the tenth intercostal space, proceeded downward, forward, and to the right, impinging upon the eleventh rib, after which it was sharply deflected backwards toward the spine. The reasons for this opinion have not been made known, and there is nothing in the report of the autopsy to sustain it. He himself says that at the first examination the wound of entrance was found to be "four inches from the median line of the spine on a level with the eleventh rib," and at the autopsy it was found that the rib was fractured at "three and one-half inches to the right of the vertebral spines." Dr. Weisse and Dr. Schrady, who were the experts selected by Dr. Bliss to examine the specimens reserved from the autopsy and to supplement his report, do not agree with him as to the direction of the wound above the eleventh rib.

Dr. Weisse says: "The ball entered opposite the tenth intercostal space, about four inches to the right of the median line of the back. It ranged in a direction forward and downward, inclining a little from right to left."

Dr. Schrady says: "It is well established by the autopsy that the ball entered four inches to the right of the median line in the tenth intercostal space, and passed forward and downward, impinging upon the eleventh rib, about three and one-half inches from the median line of the spinal column."

The course of the ball before it struck the rib is not without importance. It is evident that if it maintained the same general direction, with deflection only at obtuse angles, the course as far as the spinal column could easily have been ascertained by probing immediately after the injury and before the stage of tumefaction set in; while, if the course was originally to the right, splinters of rib and fragments of clothing would probably be carried into the tissues still further on, creating a passage simulating the track of a ball, while the true track, bending back toward the spine at a right angle, would be difficult to explore.

Although the suggestion is somewhat startling, may it not be possible that the Nelaton probe of Dr. Bliss was inserted behind the diaphragm into the pleural cavity which was certainly in communication with the wound?

It splinters the eleventh rib, traverses the pleural cavity and the diaphragm, passes *over* the left border of the right kidney, grazes the posterior surface of the liver, enters the psoas injuring the ilio-inguinal nerve; traverses the body of the vertebra in front of the spinal cord, finally lodging behind the peritoneum near the stomach. For each particular lesion distinct symptoms were shown, which, had not the surgeons been led astray by an error, must have guided them to the course of the ball. The splintering of the rib was recognized, the penetration of the pleura and diaphragm gave rise by diffuse inflammation to the trouble in the lower lobe of the right lung, the grazing of the liver caused the slight jaundice which for a day or two misled the surgeons, the injury to the ilio-inguinal nerve caused the sensations at its distribution, the crushing of the vertebra caused concussion of the cord and the pains in the feet and back, the injury to the solar plexus caused the vomiting, the cutting of the artery the internal hemorrhage. The negative symptoms were also important. There was no decided jaundice, showing the liver was comparatively uninjured. Daily evacuations of urine and feces showed the kidneys and intestines to be intact, there was no paralysis, as there would have been in case of decided injury to the cord or any great motor nerves.

The lesson which intelligent surgeons will draw from this most lamentable case is that of renewed reliance upon the practical significance of pain as an indicator of the precise lesion of organs removed from ordinary surgical examination. A considerable emphasis has been laid upon the fact that the pain gradually disappeared, Dr. Bliss apparently holding that this disappearance lessened its diagnostic value. Though this might be true in the case of slight pains connected with inflammatory lesions, it cannot be said to apply to severe and long-continued pain immediately following a gun-shot wound and referred to localities remote from the injury. The very disappearance upon which Dr. Bliss dwells, coupled with the non-development of paralysis, indicated the concussion of the cord, which we now know took place.

If the conclusions of the gentlemen conducting the autopsy are correct, the wound was necessarily fatal. Even were it possible to imagine that the injury to the spine could be repaired, the lesion of the splenic artery (if traumatic, as assumed,) would have terminated life sooner or later. And if this is the fact, some will ask why discussion is invited upon the errors in diagnosis made by the surgeons in charge. The answer is plain. It is the effort of the profession to raise the practice of medicine to a science. The error in diagnosis, even if without absolute effect in this instance, might, in another case, cost a patient his life. From the point of view of scientific medicine, the error was as grave and regrettable in the one case as in the other.

Dr. Weisse, in his report upon the case, which forms an appendix to that of Dr. Bliss, concludes by saying that there were "sufficient grounds to warrant the diagnosis that was arrived at and maintained up to the time of the death of the patient, *especially so in the absence of any evidence that the ball had taken a different course.*"

In answer to this astounding statement, I have only to offer the diagnosis arrived at by me two days after the injury, solely on information derived from the surgeons themselves.

EDITOR'S NOTE.—We have examined the original diagram in Dr. Baker's article and find that Figure 3 is an accurate reproduction of it. There is appended to the original the following certificate:

"We, the undersigned, hereby certify that, on or about the evening of July 7, 1881, this diagram was shown us by Dr. Frank Baker as representing his idea of the course taken by the ball which wounded President Garfield, July 2, 1881. Dr. Baker further stated that it was his opinion that the ball might have passed through the vertebra and lodged beyond.

"D. WEBSTER PRENTISS, M. D.

"N. S. LINCOLN, M. D.

"SMITH TOWNSEND, M. D."